SCIENCE

NEW YORK, JUNE 26, 1891.

ANTHROPOLOGICAL INVESTIGATIONS IN SCHOOLS.[1]

PHYSICAL anthropology has for its object the study of the human body and of its functions. It deals more particularly with the variation of form and function caused by varying conditions or founded on inherited peculiarities. This object is attained by dividing the human species into classes, which are treated separately. Such classes or groups may be founded on difference of race; they may be founded on difference of social status; they may be founded on difference of geographical surroundings or of age. The peculiarities of each group and their differences are brought to light by a statistical treatment of the individuals comprised in each class, and the causes of these differences are studied by comparing the various groups.

The differences between these groups are not confined to the adult age, but develop during the period of childhood and adolescence. Therefore the study of the latter forms a most important branch of anthropology. It appears that the differences between the classes are comparatively slight in the beginning, but develop during the period of growth, so that the adults of the various groups show much greater divergences than the children of the same groups. These differences in the adult stage may be brought about by earlier arrest of development in certain groups than in others, or by development in diverging directions. Differences of form are generally accompanied by differences of function.

From these general considerations we must conclude that a study of the anthropology of children is of the greatest importance for a knowledge of the conditions and laws of growth. It appears probable that the mode of growth of a city population and of a country population will be found different, as the adult forms show certain differences. The American child grows differently from the European child, for there exist differences between the adult American and the adult European. The child in New England grows differently from the child in Kentucky, as the adult forms of the two countries are not the same. We may also assume that the child growing up under favorable sanitary conditions will develop differently from the less fortunately situated child. Even where the adult forms are identical we may find differences during certain stages of development which may shed an important light upon questions referring to growth.

The problems which are touched upon here have a great importance to the teacher, because the functions of any organ and also of the whole body are closely related to its development and form. The nature of this correlation is by no means clear, but remains largely a matter of investigation. Nevertheless, its existence cannot be doubted. One of the most striking cases of this kind is the result obtained by Axel Key in his extended investigations in Sweden. He found that the liability to sickness decreases with increasing rate of growth and increases with decreasing rate of growth, so that the one may be taken as the measure of the other. We know from other sources that skill in the use of certain parts of the body cannot be attained after growth has been completed, but that it must be attained during the period of development, so that the special nature of practice has an influence upon the function and probably also upon the form of the organs in the adult individuals. Piano players and rope dancers may be mentioned as instances of this kind.

The various parts of the body do not develop at the same time. Therefore we must suppose that each has its peculiar time during which it is best adapted to being trained. For these reasons the teacher has an immediate interest in the prosecution and in the results of investigations upon the bodily development of school children.

Most researches on growth have been made from purely anthropological points of view, the relation of the investigations to school work having been brought out only lately. Quetelet's investigations in Belgium were among the first that were founded on extensive material. The subject did not receive, however, great attention, until Dr. H. P Bowditch made his classic study of the school children of Boston and vicinity. His measurements included height standing, and weight. Simultaneously Dr. Charles Roberts carried on similar investigations in England. In his work are found a considerable number of data referring to the development of the various parts of the body, some of which have been taken from Quetelet's tables. Dr. Bowditch's measurements were repeated in Milwaukee by George W. Peckham, who showed that certain important differences in the rates of growth prevail in that city and in Boston. Series of observations of less extent were made by Pagliani in Turin in 1879, by Kotelmann in Hamburg in 1877, by Daffner in the military schools of Bavaria in 1884.

Michailoff carried on an investigation on a closely allied subject in Moscow, where he studied the development of the chest, a question which was also included in Dr. Roberts's measurements. An interesting article on this work has been written by Erismann. Another investigation carried on in Kretcy, Russia, by I. A. Müller, has not been accessible to us.

Lately the superintendent of schools of Freiburg in Saxony had a series of measurements made, in order to determine the proper height of seats for scholars of various classes. The most important work of this kind, and one which claims particular attention of educationists, because it has been undertaken on a large scale and solely in the interest of schools, is the inquiry of the Royal Swedish Commission, whose work was edited by Axel Key.

All these investigations were based on statistical material, that is, on the treatment of a long series of observations, but no effort was made to follow the same individuals through a series of years. Although Vierordt claims that the former method will give just as good results as the latter, provided the number of observations is sufficiently large, it must be borne in mind that the latter method, the individual method, will give many results which the general method cannot give, and that it is the only method that will allow the education-

[1] Dr. Franz Boas in the Pedagogical Seminary for June.

ist to apply the results of the general method to practical cases. Liharzik in Vienna measured twenty children regularly from the day of their birth to their eighth year, and two hundred boys from their eighth until their fourteenth year. The first to make an investigation of this kind with special reference to school work was Dr. Wretlind, who measured the increases of children during vacations and during the term. In Denmark Dr. Vahl made semi-annual weighings of the girls at Jägerspris. He arrived at the conclusion that weighings of this kind are the only means of controlling satisfactorily the sanitary conditions of school children. The studies of R. Malling-Hansen indicate that the development depends upon climatic conditions, in so far as the winter seems to cause a retarding influence. If this is true, schools in northern countries ought to have longer summer vacations than schools in southern countries, in order to make up for the lesser growth during the cold season. An important investigation of this character has also been made in Germany by Dr. Landsberger, in Posen, who followed the growth of one hundred and four children through a period of five years.

Most of these investigations deal with the growth of the whole body; they refer only incidentally to the growth of certain parts of the body. Valuable material on this point is, however, contained in Dr. Landsberger's investigation. He found, for instance, that during school age the diameters of the head change only very slightly, while the growth of the body as a whole is very rapid. The next step to be taken in researches of this kind will be the study of the growth of individual parts of the body in connection with their functions. The growth of the hand, together with its increase in strength, ought, for instance, to be studied. The remarkable changes in the curvature of the skull, the relative development of face and head, in short, the development of each part of the body, ought to be made the subject of most searching and careful inquiry. The results to be obtained from investigations of this kind will undoubtedly teach us how to develop the faculties of children each at its proper time.

ISOLATION OF A CHOLERA TOXINE.

HERMANN SCHOLL (*Berlin. klin. Woch.*, Oct. 13, 1890) communicates an interesting paper giving the results of some experiments with a poisonous body isolated from cultivations of the cholera bacillus. According to the *British Medical Journal*, he thinks it curious that in all previous investigations on the nature of the cholera, toxine cultivations should have been used which had been grown in the presence of air; whereas, in his opinion, in order to imitate the conditions under which the cholera bacillus grows in the human intestine, the most essential point is that the culture be grown in the absence of air. In this assumption he follows Hueppe and Cartwright Wood, who, he considers, have satisfactorily shown that the cholera bacilli grow in the small intestine in the absence of oxygen, and that their extreme virulence or rapidity of poison production depends chiefly on this anaerobic growth. Other observers, among whom Petri may be cited, think that this point requires more rigorous proof than has yet been afforded.

To obtain this anaerobic growth, the author used the method introduced by Hueppe of growing the bacilli in raw eggs, by which means he holds that oxygen is completely excluded. The inoculated eggs were kept for eighteen days at a temperature of 36° C. When opened the contents were found to give off a very powerful smell of sulphuretted hydrogen, differing in this from cultures grown in air. He describes the white of the egg at this period as being fluid and watery, the yolk firmer in consistence and black in color. In order to test the toxicity of the egg contents, five cubic centimetres of the fluid part were injected into the peritoneal cavity of a guinea-pig. The animal at first showed signs of paralysis, then convulsive movements, and died at the end of forty minutes. This proved that the fluid egg albumen was very poisonous.

The author then proceeds to describe his method of isolating the poison. Briefly, it is as follows. The fluid part of the egg contents, which amounted to 150 cubic centimetres, was dropped into ten times its volume of absolute alcohol. The white precipitate thrown down was collected and digested with 200 cubic centimetres of water at 40° C. The effect of this was to dissolve only a very small quantity of the precipitate, which was then removed by filtration. Eight cubic centimetres of the transparent filtrate were then injected into the peritoneal cavity of a guinea pig, and caused death in one minute and a half. This fluid entirely lost its poisonous properties on being boiled in the steam sterilizer for half an hour, while a short heating to 75° C. had no such effect. On the other hand, when placed at 40° C. *in vacuo*, over chloride of lime, the fluid was found next day to be completely inert.

The author then subjected the poison to the usual chemical tests, and came to the conclusion that it was no ptomaine, but a peptone, differing, however, from the toxo-peptone isolated by Petri from aerobically grown cultivations. This peptone could be obtained in a solid form by dropping the watery solution into eight to ten times its volume of a mixture of the ether and alcohol, rendered faintly acid by acetic acid. The resulting precipitate was found to be insoluble in pure water, but soluble on the addition of an alkali. After repeating this precipitation and resolution several times, pure ether was substituted for the mixture of ether and alcohol, and the peptone obtained after evaporation as a white bulky substance. A very small quantity of this dissolved in water was then injected into the peritoneal cavity of a guinea-pig. The animal at once became totally paralyzed. After half an hour convulsive movements of the head and extremities set in, and at the end of five hours the guinea-pig died. The author concludes, as the result of his experiments, (1) that the poisonous peptone, elaborated by the cholera bacilli under conditions of anaerobiosis from the albumen of the egg, is different from the toxo-peptone of Petri, since the latter was not decomposed on boiling, while the former was; (2) that this cholera pepto-toxine is much more poisonous than the toxines found by Brieger and Petri in cultures grown under aerobic conditions, since the poison obtainable from a single egg was capable of killing ten guinea-pigs in the space of ten minutes; (3) that these experiments are in favor of the contention of Hueppe and Wood that the cholera bacilli, when grown anaerobically, form a greater quantity of, and a more powerful, poison than when grown aerobically.

NOTES AND NEWS.

THE *Pedagogical Seminary* says that in Darmstadt and other large German cities pot-plants are given to school children who live in tenements. They are usually three in number and of the same size, with printed directions how to care for them. At the end of a year are exhibitions and prizes.

— At a meeting of the Royal Society, London, on June 4, the following gentlemen were duly elected fellows of the society: William Anderson, Professor Frederick Orpen Bower, Sir John Conroy, Professor Daniel John Cunningham, Dr. George M. Dawson, Edwin Bailey Elliott, Professor Percy Faraday Frankland, Percy C. Gilchrist, Dr. William Dobinson Halliburton, Oliver Heaviside, John Edward Marr, Ludwig Mond, William Napier Shaw, Professor Silvanus P. Thompson, and Captain Thomas Henry Tizard.

— According to the *Engineering and Mining Journal*, Professor Salisbury of the United States Geological Survey has made arrangements with Professor Smock, in charge of the Geological Survey of New Jersey, to undertake geological studies of the formation of the surface in sections of New Jersey, with especial reference to the glacial drift. He will begin work next month, and his study will be confined to Middlesex, Union, and Essex Counties during the summer. Monmouth and Mercer Counties may also be visited.

— A press dispatch from San Francisco says that the Czar of Russia has presented the Stanford University with a complete collection of Russian and Siberian minerals taken from the St. Petersburg Museum. The collection is valued at about $35,000, and comprises some eight hundred specimens. Mrs. Stanford will, in return, it is stated, send the Czar a collection of California minerals and precious stones.

— The object of the Society of American Friends of Russian Freedom, recently organized by well-known Americans, is to aid by all moral and legal means the Russian patriots in their efforts to obtain for their country political freedom and self-government. Those who wish to join this society and receive also *Free Russia* (published monthly), should send their names and post-office addresses, with the membership fee of one dollar, to Francis J. Garrison, treasurer, 4 Park Street, Boston, Mass.

— A meeting of the Baltimore Branch of the Archæological Institute of America was held on April 26. Major J. W. Powell of the United States Geological Survey spoke of the Zuñi Indians. Officers were elected as follows: president, Daniel C. Gilman; vice-presidents, Mendes Cohen, Basil L. Gildersleeve, William W. Spence, and Arthur L. Frothingham, Jun ; treasurer, Henry F. Thompson; secretary, J. Le Roy White; delegates to the council, David L. Bartlett and Arthur L. Frothingham, Jun.

— According to the *Pedagogical Seminary*, in Russia, Servia, Roumania, and Bulgaria over 80 per cent of the population are illiterate, Spain 63 per cent. Italy 48 per cent, Hungary 43 per cent, Austria 39 per cent, Ireland 21 per cent, France and Belgium 15 per cent, Holland 10 per cent. United States (whites) 8 per cent, Scotland 7 per cent, Switzerland 2.5 per cent, some parts of Germany 1 per cent. In Sweden, Denmark, Bavaria, Wurtemberg, and Saxony only rarely a person cannot write.

— Esquirol called attention to the fact that idiots without the power of speech could sing. Dr. Wildermuth of Stettin compared 180 idiotic children with 80 normal children in regard to vocal range, sense of harmony, and memory for melody; and 27 per cent of the idiots and 60 per cent of the normal children were classed as musical in the highest degree, 11 per cent of the idiots and 2 per cent of the normal children were without musical ability. This remarkable relative development of the musical sense in idiots, says the *Pedagogical Seminary*, is the more striking as there is no evidence of any other artistic taste. The practical outcome of Wildermuth's observations is to emphasize the necessity of vocal culture in the training of idiots.

— The Society of Arts, London, offers a gold medal or £20 for the best invention having for its object the prevention or extinction of fires in theatres or other places of public amusement. In cases where the invention is in actual use, reference should be made to places where it could be inspected. A full description of the invention, accompanied by such drawings or models as are necessary for its elucidation, must be sent in on or before Dec. 31, 1891, to the secretary of the Society of Arts, John Street, Adelphi, London.

— Those interested in questions relating to physical education will find much to please them in a paper, in the June number of *Physique*, by the Rev. T. A. Preston. Many boys are not much attracted by games, and it seems hard that in such cases any sort of compulsion should be used. Why not have various alternative ways of securing exercise, any one of which might be chosen? Mr. Preston shows with great force, says *Nature*, and in a very interesting manner, with how much advantage the study of natural history might in some instances be substituted for cricket and football. Boys out for a field excursion take a great deal more exercise, he maintains, than is ever taken at cricket. "With those who are keen naturalists," he says, "the mere exercise taken in any one day (not in an excursion) is often such that it might almost be said to require moderating. I have no hesitation in saying that, if exercise alone is to be considered, a field naturalist will take far more than any one at games."

— A series of experiments with regard to evaporation from free water surfaces and from earth saturated with water, in sun and in shade, has been recently made by Signor Battelli. *Nature* states (quoting from *Il Nuovo Cimento*) that he used three large tubs or vats, two holding water, and the third earth on a grating, to which water was admitted from a pipe entering the bottom. One water-tub and the earth-tub stood a few yards apart on the north side of a high wall; the other water-tub was in the open, and embedded in the ground. Signor Battelli's results are these: The quantity of water evaporated from moist earth is in general greater than that from a free stagnant water surface, when the air temperature rises; but less, when the latter falls. With increasing wind-velocity, evaporation increases more rapidly from the water surface. The moister the air, the greater (other things equal) seems to be the ratio of the water evaporated from the moist earth to that from the stagnant water surface. The evaporation of a water surface exposed to the sun's rays is greater than that of a shaded one, not only by day, but in the following night. With rising temperature, the ratio between the water quantities from these two surfaces increases somewhat more quickly; with rising wind-velocity, this ratio diminishes.

— Dr. S. V. Clevenger, in the *Alienist and Neurologist* for July, 1890, describes an infant prodigy, Oscar Moore. Two little colored children were reciting the multiplication table at their home, in a little cabin in Texas, as they had repeatedly done before, and one of them asserted that four times twelve was fifty eight, whereupon a thirteen months old baby, Oscar Moore, who had never spoken before, corrected the error by exclaiming, "Four times twelve are forty-eight!" There was consternation in that humble home until the family became reconciled to the freak. Oscar was born in Waco, Texas, in 1885; his father is an emancipated slave, his mother is a mulatto. He was born blind; the other senses are unusually acute; his memory is the most remarkable peculiarity. He is intelligent and manifests great inquisitiveness: his memory is not parrot-like. When less than two years of age he would recite all he heard his sister read while conning her lessons. He sings and counts in different languages, has mastered an appalling array of statistics, and is greatly attracted by music. The writer concludes that Oscar is not mentally defective, but may possess extraordinary mental powers.

— A direct observation of hail in the process of formation is recorded in the *Naturwissenshaftliche Rundschau* and noted in a recent number of *Nature*. In the afternoon of a squally day Professor Tosetti, looking eastwards through the window of a house (in northern Italy) which, with two others, inclosed a court, saw the rain which streamed down from the roof to the right, caught by a very cold wind from the north, and driven back and up in thick drops. Suddenly a south wind blew, and the drops, tossed about in all directions, were transformed into ice balls. When the south wind ceased, this transformation also ceased, but whenever the south wind recurred, the phenomenon was reproduced, and this was observed three or four times in ten minutes.

— So much has been said and written upon the smoke-abatement question in England that the idea of utilizing this dire enemy of public health and cleanliness so as to actually make its existence a source of profit is somewhat attractive. In a lecture recently delivered by Professor V. B. Lewes, reference was made to certain facts in this connection, of high interest. As given in *Invention*, one of these facts was that at three or four Scotch ironworks the Furnace Gas Company are paying a yearly rental for the right of collecting the smoke and gases from the blast-furnaces. These are passed through several miles of wrought-iron tubing, diminishing in size from six feet down to eighteen inches, and as the gases cool there is deposited a considerable yield of oil. At Messrs. Dixons' at Glasgow, which is the smallest of these installations, they pump and collect about 60,000,000 cubic feet of furnace-gas per day, and recover on an average 25,000 gallons of furnace oil per week, using the residual gases, consisting chiefly of carbon monoxide, as fuel for distilling and other purposes, while a considerable yield of sulphate of ammonia is also obtained. In the same way a small percentage of the coke-ovens are fitted with condensing gear, and produce a considerable yield of oil, for which, however, in its crude state, there is but a limited market, the chief use being for lucigen and other lamps of the same description, and for treating timber for railway sleepers. In view of such arrange-

ments Professor Lewes is not unnaturally sanguine that the smoke-fiend may eventually be dealt with in a way quite as satisfactory, but far more profitable than mere self-consumption. The oil above described can, for instance, be greatly improved in quality by ridding it of the large percentage of watery particles it contains when freshly condensed. Mr. Havely of Baghill, England, has devised a process whereby not only the water, but the paraffine, cresol, and phenol, are removed from the crude oil, leaving the residuum in better condition, and of high value for timber. This oil, Professor Lewes asserts, can be used as an enricher of gas, enabling gas of a higher illuminating power to be produced at a reduced cost. If this be true it will not be the least remarkable instance of waste-products of a process becoming even more valuable than the original article manufactured.

— A correspondent of *Indian Engineering* says he recently witnessed a very interesting mode of obtaining a foundation for a new building. A hole was bored in the ground (which was previously damp), from ten to twelve feet deep and an inch and a half wide, and a string of cartridges was lowered into it. The subsequent explosion not only produced a cavity a yard in diameter, but also drove the water out of the surrounding earth by means of the expansive action of the gases. The water did not return to its former place for fully an hour, so that an opportunity was afforded to fill up the cavity with quickly settling concrete, and a rapid rate of working was thus attained.

— In his recent lecture on fire prevention Professor Goodman states, says the *Builder*, that, generally speaking, wooden joists are better for buildings than steel or iron joists. The two latter materials, he explained, lose their strength at a not very high temperature, whereas wood would sustain a heavy strain for a much longer period when exposed to great heat. Besides, when wood has once been charred, it does not burn so readily again. Iron and steel soon expand under the influence of heat. Brick and stone are objectionable: the former become fused under great heat, and the latter is liable to crack or fly when suddenly cooled after heating. The drawback to tiles is, that, when fire plays upon the joists of floors fitted with them, the joists expand and allow the fire to play upon the joists through the tiles. Portland cement is objectionable, as it flakes off when heated, but if wire netting or bars are embedded in concrete this defect is remedied. A joist padded with silicate of cotton and incased in salamander plaster (a mixture of silicate, cotton, and plaster-of-Paris), the professor holds, is a splendid fireproofing material. Such a material is not only a non-conductor, but it is elastic, and would yield with the joist. In an experiment undertaken by Professor Goodman it was found that a joist of this kind withstood very fierce heat for eight to nine hours without sustaining any serious damage.

— Dr. J. Hann has communicated another important treatise to the Vienna Academy, entitled "Studies on the Conditions of Air-Pressure and Temperature on the Summit of the Sonnblick," with remarks upon their importance for the theory of cyclones and anticyclones. The work is based upon four years' observations, and is divided into eight sections, which are given in *Nature* of June 4 as follows. (1) An investigation of the general meteorological conditions under which the maxima and minima of air-pressure occur on the Sonnblick. The anomalies of pressure are more marked above than below, and are increased by the accompanying temperature anomaly, which is relatively high in barometric maxima, and relatively low in barometric minima. (2) The range of temperature during the passage of a barometric wave. This is, at least during the winter season, the opposite to that at the lower level. (3) Temperature with varying amount of cloud in winter. The highest temperature coincides with the least cloud, upon the summit, and conversely on the plain. The clear winter days on the Sonnblick have relatively high temperature with great dryness, and these conditions are characteristic of the barometric maxima. (4) Monthly maxima and minima of temperature. The former mostly occur during barometric maxima, and the latter when the high pressure lies in the west or north, and while a barometric minimum exists over Italy or the Adriatic. (5) Temperature and air-pressure on the Sonnblick during barometric minima over central Europe, especially over the eastern Alps. The mean temperature at the height of 6,650 feet during the passage of barometric minima was below the normal, amounting on an average to 2.5° F. during the winter season. The use of deviations of pressure and temperature in answering many questions of atmospheric physics is here discussed. (6) Vertical distribution of temperature, and mean temperature in a column of air of three kilometres in height. The calculations have been made separately for each winter. (7) Preliminary indications respecting the relations of the wind-directions to barometric maxima and minima. A considerable divergence (45° to 90°) is shown from the directions as observed below, and the results confirm the conclusions drawn from cloud observations by J. A. Broun and others. (8) Refutation of some objections against the conclusiveness of temperature observations on mountain summits, and general remarks on cyclones and anticyclones. The author points out that recent mountain temperature observations and other facts are opposed to the explanation of barometric maxima and minima in extra-tropical regions by purely thermic considerations.

— According to *Engineering*, Messrs. David Moseley & Sons, of Manchester, are introducing a form of battery zinc in which the element is built up of a number of tubes constructed of thin sheets, which can be obtained in great purity. These tubes are slipped inside each other to form the element. Each tube is amalgamated before the element is put together, and the mercury permeates the whole wall of the tube, as the latter is only one-thirty-second of an inch thick, and the zinc is very pure. The amalgamation is accordingly very perfect, and local action is entirely got rid of. The manufacturers state that when these elements are used, no time has to be spent in cleaning and scraping the zincs, which remain free from chloride of zinc and crystals till completely expended.

— Considering the question of determination of the evaporating power of a climate, Dr. Ule distinguishes (*Met. Zeits.*) between the intensity and the speed of evaporation. The latter, says *Nature*, can be well determined with an instrument like Wild's evaporimeter; and Dr. Ule sets forth, in a table, the monthly data of this for Chemnitz, compared with those of absolute humidity, "saturation deficit," and relative humidity. The agreement of the last with the evaporimeter figures is much better than that of the two others; still, there is considerable discrepancy, and this is not explained (the author shows) by variations in wind-intensity. On the other hand, the data of the psychrometer show a remarkable parallelism with those of the evaporimeter, and by taking wind-variations into account the agreement is increased. Thus, from psychrometer-differences and wind-variations, the evaporative power of a climate may be correctly estimated where an evaporimeter is wanting. Dr. Ule offers a new formula for estimating the layer of water evaporated in a given time, and tests it with two German climates and one Australian.

— The government of the Dutch East India colonies has instituted a prize competition open to the world. The Dutch government is a large producer of salt on the island of Madura, and it is anxious to find a practical way of packing the salt, as it is retailed for government account. To the contestant who offers the best and most economical method the Dutch government offers to pay $4,000. The government salt comes from the numerous open salt ponds in the island named. After the product from these ponds has been partly dried by solar heat it is brought to the government store-houses, where it remains for a year or longer. The product is light gray, of irregular crystals, and likely, if exposed to climatic influences, to absorb moisture and melt. For this reason the Dutch colonial government wants the salt packed in such a way that the weather cannot affect it, a desideratum which it has yet failed to obtain. The material used in packing must be proof against the action of the salt and at the same time must not injure the salt in any way. It must also be strong enough to preserve the salt for at least two years, and after the cans or boxes are closed the salt must not melt. The cans or boxes must hold just a kilogram of salt each, to be packed in larger cases for transportation. It is estimated that for the total yearly production 74,150,000 cans or boxes of one kilogram each will be needed. The packing

operation will, if required, have to be preceded by an artificial drying process, as it has been found that salt carefully dried is more easily preserved. A detailed statement of costs must be filed, and for wages the average paid in the Netherlands must be figured upon. A special contest will take place at Amsterdam between the competitors. For this the contestants must supply the necessary materials and machinery. The government will buy from the contestant receiving the premium the machinery used by him at the contest. Answers must be filed with the Department of the Colonies at the Hague before Sept. 1.

— A butter extractor (or extractor separator), a new machine for making butter directly from fresh milk, is now being run regularly at the Pennsylvania Agricultural Experiment Station, on Mondays, Wednesdays, and Saturdays of each week. Any persons desiring to see the operation of the machine will be welcomed and given every facility for investigating its workings. Visitors from a distance should purchase railroad tickets to Lemont. A stage connects with all trains.

— Medical studies of the school children in Berlin showed that 25 per cent had more or less defective hearing, most of them being thought deaf enough to be incommoded in their work. The *Pedagogical Seminary* remarks that such partially deaf children are often thought unjustly by their teacher to be inattentive. More effort of attention is needed by such children, who are usually utterly incredulous concerning their defect, although they often complain that the teacher speaks too low or indistinctly. Children from better homes are less often defective than those from squalid ones.

— Beginning on Wednesday, July 1, and continuing six weeks, there will be held at Plymouth, Mass., a school for the discussion of practical ethics in the broadest sense of that phrase. The matter to be presented has been selected with regard to the wants of clergymen, teachers, journalists, philanthropists, and others, who are now seeking careful information upon the great themes of ethical sociology. The course of lectures will cover three different departments: economics, history of religions, and ethics proper. The department of economics will be in charge of Professor H. C. Adams of the University of Michigan. Professor Adams will deliver seventeen lectures, three during each of the six weeks, on the history of industrial society and economic doctrine in England and America, beginning with the middle ages, and tracing genetically the gradual rise of those conditions in the labor world which cause so much anxiety and discussion to-day. His associates and the topics which they will treat are as follows: Professor John B. Clark of Smith College, "Modern Agrarianism;" Albert Shaw, American editor of the *Review of Reviews*, "Social Questions suggested by the Crowding of Cities;" Professor Edmund J. James, president of the American Society for the Extension of University Teaching, "Education in its Social and Economic Aspects;" Henry D. Lloyd of Chicago, "Trusts;" Professor Frank W. Taussig of Harvard University, "Co-Operation;" Hon. Carroll D. Wright, United States Commissioner of Labor, "Factory Legislation;" President E. Benj. Andrews of Brown University, "Socialism." The department of the history of religions will be in charge of Professor Crawford H. Toy of Harvard University. Professor Toy will offer a general course of eighteen lectures, extending through the six weeks, treating the history, aims, and method of the science of history of religions, and illustrating its principles by studies in the laws of religious progress, with examples drawn from the chief ancient religions. His associates and their topics are Professor M. Bloomfield of Johns Hopkins University, "Buddhism;" Professor George F. Moore of Andover Theological Seminary, "Islam;" Professor Morris Jastrow, Jun., of the University of Pennsylvania, "The Babylonian-Assyrian Religion;" Professor G. L. Kittredge of Harvard University, "The Scandinavian Religion;" Professor B. I. Wheeler of Cornell University, "The Greek Religion;" Mr. W. W. Newell, editor of the *Journal of American Folk-Lore*, "The Religion of the Laity in the Middle Ages." The department of ethics will be in charge of Professor Felix Adler of New York City. Professor Adler will offer a general course of eighteen lectures, extending through the six weeks, on the system of applied ethics, with special reference to the moral instruction of children, including a brief survey of the various schemes of classification adopted in ancient and modern ethical systems, the discussion of the relation of religious to moral instruction, of the development of the conscience in the child, etc. His associates and their topics are Dr. Charlton T. Lewis of New York, "Criminals and the State;" Professor J. B. Thayer of Harvard Law School, and Hon. Herbert Welsh of Philadelphia, "The Indian Question;" Mr. J. H. Finley, secretary of the State Charities Aid Association of New York, "The Problem of Charity in Great Cities;" Rev. C. R. Eliot of Boston, "Temperance Reform and Legislation;" Emil G. Hirsch of Chicago, "The Ethical Ideal in Education;" Professor Wm. E. Sheldon of Boston, "Humane Treatment of Animals;" Mrs. Caroline Earle White, president of the Woman's Branch of the Pennsylvania Society for the Prevention of Cruelty to Animals, "Vivisection;" Mr. W. L. Sheldon of St. Louis, "Reform Movements among Workingmen;" Mr. Wm. M. Salter of Chicago, "Ethical Theory;" Professor Robert Ellis Thompson of the University of Pennsylvania, "Politics and Ethics."

— In the course of an investigation, part of which has already been communicated to the Royal Society, Professor Roberts-Austen has discovered the most brilliantly colored alloy as yet known. *Nature* states that it has a rich purple color, and bright ruby tints are obtained when light is reflected from one surface of the alloy to another. It contains about 78 per cent of gold, the rest of the alloy being aluminum. The constants of the aluminum-gold series of alloys are now being examined, and will shortly be published.

— According to *Nature*, the relations of weather and disease have been recently investigated by Herr Magelssen of Leipzig, who, having formerly called attention to the nature of certain "waves" which recur in the variations of temperature (distinguishing waves of about 12 days, 50 days, and 18 to 20 years duration), now traces a connection of these with diseases and mortality. The year-waves especially show this connection, the mortality (in our latitudes) varying with the winter temperature. The least mortality (relatively) is at the middle part of the temperature periods. The injurious influence of heat is dominant in the more southern latitudes (such as Vienna), while cold begins to act beneficially. In northern places, mild winters prove injurious where several very mild winters come in succession (e.g., Stockholm in 1871–74). The most favorable conditions seem to be an alternation of moderately cold and moderately mild winters. Too much importance, the author thinks, has been attached to relative humidity. He further offers proof that infectious disease is even more dependent on weather than disease of the respiratory organs, or arising from chill.

— The value of systematic observation of snow is now being recognized in meteorology, says *Nature*, and in Russia observations were commenced in January last year at 428 stations in the European portion of the empire, 21 in the Asiatic, and 55 in the Caucasus. At first it was simply reported daily whether there was a continuous snow-covering about the station or not. But last winter the inquiry had been extended to the depth and general behavior of the snow. Thus it is expected that in a few years some valuable climatological material will have been accumulated at St. Petersburg. The report of Herr Berg on the snow in the early months of 1890, in European Russia (*Repert. für Meteor.*), contains a map showing the southern and western limit of the continuous snow-covering for the first and fifteenth of each of the months from January to April. In the west the snow extended steadily till the beginning of March, the limit being then close to the Baltic. In the south-east, there was steady advance till February, and as far as the coast of the Caspian. In the south, the advance was fluctuating, there being a maximum in the middle of January and in the middle of February, both reaching to the Black Sea coast. The retirement of the snow-limit began in the south and south-east in the middle of February; in the west about half a month later. The general direction was north-east. On April 15 the limit passed through Onega on the White Sea, Wetluga, and Katherinenburg. By the first of May all European Russia was free from snow. Herr Berg describes the weather accompanying the disappearance of the snow, and traces its causation.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer: not necessarily for publication but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE CHEMICAL LABORATORY OF THE CASE SCHOOL.

THE "First Annual Report of the Chemical Laboratory of Case School of Applied Science," Cleveland, Ohio, which is under the directorship of Professor C. F. Mabery, contains a brief review of its development since the school was opened in 1881. The liberal expenditure at first granted by the trustees for chemical supplies, and for equipment of the temporary laboratory, laid the foundation for immediate arrangement of the course of study, which became necessary to meet the demand for instruction in chemistry. Upon the removal of the school to the new building on Euclid Avenue, in September, 1885, the commodious, well-lighted rooms on the third story were assigned to chemistry, and they were occupied until the building was burned in October, 1886. In promptly providing for the continuance of instruction after the fire, in a separate building, the trustees made it possible to resume laboratory work with a delay of less than four months. This building has served an excellent purpose during the four years it has been occupied, and the great amount of labor that has been expended in developing the course of study will be apparent when they are expanded in the more spacious rooms of the new laboratory. The first graduates in chemistry were of the class of 1886, and fifteen now fill responsible positions as chemists and professors of chemistry. Two of the graduates have received the degree of doctor of philosophy from the University at Berlin, and two others have nearly completed an advanced course of study, one at the University at Heidelberg, Germany, and the other at Zurich, Switzerland.

For the best development of chemical training, the beneficial influence of original research or study of special problems upon students as well as instructors, is recognized; and while it may be possible to include very little of this work in a course of study for undergraduates, the general effect of such an atmosphere is stimulating to their ambition. Then, too, questions constantly arise in professional pursuits that can only be determined by the application of knowledge independent of routine methods. The investigations carried on were on subjects of considerable practical importance. An exhaustive study by Mr. A. W. Smith of the composition of the water of the lake at different points along the shore, and the influence of varying currents in causing contamination, indicated the direction that an extension of the inlet tunnel should take to provide the best supply for the city. A paper on salt brines led to the perfection by Dr. Dow of a process now in operation for the extraction of bromine from brines that promises to replace the older methods. Although many methods have been proposed and protected by patents for the removal of sulphur from Ohio petroleums, the results of investigations made at Case School gave the first information concerning the forms of the sulphur compounds in these oils. The examination of oils from other localities promises interesting results. Since 1884 investigations have been constantly in progress in the laboratory on the metallurgy and uses of metallic alluminum and its alloys, and they have contributed to the great reduction in price of the metal and to its more general use in the arts.

THE AMERICAN SOCIETY OF MICROSCOPISTS.

THIS association, now in the thirteenth year of its existence, will hold its fourteenth annual meeting in Washington, D.C., beginning Aug. 10, and continuing in session five days. Its roll of active members contains about three hundred and fifty names, embracing nearly every person in the United States who is at all prominent as a microscopist. Its membership consists of two distinct classes; viz., professional men and students of the natural sciences, who use the microscope in their daily avocations as an instrument of research, diagnosis, or precision; and amateurs, or those who find pleasure and profit in the revelations of the instrument. Many of the latter class, from having early chosen special lines of study and investigation, have acquired high reputations in their respective departments of microscopical research. In its earlier years this class predominated in the membership of the society, but at present the professional element is largely in excess.

The qualifications for membership are very simple. The applicant must be a respectable person socially, and interested in the use of the microscope.

The advantages of membership are dual in their nature; i.e., general and social, or those which accrue to the individual from association with others engaged or interested in the same pursuits in any and all walks of life; and special, in that the meetings of the society are to a certain extent educational in their nature. In the "working sessions" experts in every department of microscopical technology are engaged in giving manual demonstrations of the details of their lines of work: in the informal evening *conversaziones* the room of every worker who has anything special to exhibit or demonstrate is open for the reception of all those who wish to witness the demonstration; finally, the *soirée* affords an opportunity of displaying for the benefit of the members, as well as the public generally, all that is most beautiful, interesting, and instructive in the cabinets or laboratories of the exhibitors. Of late years the *soirées* have been attended by many thousands of visitors in every city in which the society has met, and have been regarded as distinguished social as well as scientific events.

The dues are only two dollars per annum, and in return the member gets a volume of the "Annual Proceedings," which costs very nearly this amount. All persons, professional or amateur, interested in microscopy and not already on the rolls, are invited to send in their applications for membership to the secretary, Dr. W. H. Seaman, 1424 Eleventh Street, Washington, D.C. The application should be accompanied by three dollars, which is the initiation fee and one year's dues. Any further information concerning the society or the approaching meeting may be obtained by addressing Frank L. James, president, Box 568, St. Louis, Mo.; W. H. Seaman, secretary, 1424 Eleventh Street, Washington, D.C.; or C. C. Mellor, treasurer, 77 Fifth Avenue, Pittsburgh, Penn.

INTERNATIONAL CONGRESS OF GEOLOGISTS.

THE Committee of Organization of the International Congress of Geologists announces the following details with regard to the meetings of the Fifth Geological Congress, to be held in Washington from Aug. 26 to Sept. 2, and for excursions which will follow.

The meetings will be held in the rooms of the Columbian University, at the corner of Fifteenth and H Streets. A large lecture-room, and smaller rooms for meetings of the council, exhibition of maps, rocks, minerals, etc., have been set apart for this purpose. Special postal, telegraph, and messenger service will be arranged in the building during the week of the meeting, and a bureau of information, where members will register. Those who arrive before the opening of the congress are requested to register their names at the secretary's office, 1330 F Street.

The meetings of the American Association for the Advancement of Science, and of the Geological Society of America, which will take place during the week preceding that of the meeting of the congress, will be held in the same building. The daily programme of the several meetings is as follows.

Aug. 19 to 22. — Meetings of the various sections of the American Association for the Advancement of Science. The foreign members of the congress have been made honorary associate members of the association by its council, and are thereby entitled to take part in its geological and archæological excursions in the vicinity of Washington, and to avail themselves of the reduced rates of fare on railroads which are accorded to its members. American members of the congress who are not already members of the association are invited to join it at the present meeting.

Aug. 24 and 25. — Meetings of the Geological Society of America. The foreign members of the congress are likewise invited to attend the meetings of this society, to contribute papers, and to take part in the present meeting.

Aug. 26 to Sept. 2. — Meetings of the International Congress of Geologists.

Besides the regular subjects of discussion, such as unfinished business of the former congress, reports of committees, etc., the Committee on Organization recommends that the following subjects be made special topics for the consideration of the congress at this meeting: (I) Time correlation of the clastic rocks; (1) correlation by structural data; (*a*) by stratigraphical data, (*b*) by lithological data, (*c*) by physiographical data; (2) correlation by paleontological data; (*a*) by fossil plants, (*b*) by fossil animals; or (*a*) by marine fossils, (*b*) by terrestrial fossils: (II) General geological color schemes and other graphic conventions: (III) Genetic classification of the pleistocene rocks.

The Committee of Organization has arranged with Thomas Cook & Son for reduced rates on certain lines of ocean steamships, for members coming from Europe. On all the principal railroads of the United States, members can obtain a reduction of one-third on regular rates from all main points to Washington and return, if they are members of the American Association for the Advancement of Science, or become so during the meeting. For this purpose it is only necessary in buying a ticket for Washington to obtain from the agent a receipt for the amount paid, on a particular form furnished him for this purpose. When the member leaves Washington, the presentation of this receipt, together with the membership card of the association, will entitle him to a return ticket over the same route for one-third the regular fare.

The long excursion will be made on special trains, carrying seventy-five persons, and fitted with all the latest appliances for the comfort of travellers. It will constitute a moving hotel, permitting free and safe passage from one end to the other at all times, and will take the party wherever the rails are laid in the regions visited, and stop wherever desired. As at present planned the excursion will occupy twenty-five days, and cost $265 per person, which will cover every necessary expense. The route laid out covers thirty-eight degrees of latitute and twelve of longitude, and enables the traveler to see the finest scenery and most important geological phenomena of the Eastern States, the Mississippi Valley, and of the Rocky Mountain region, passing a week among the wonders of the Yellowstone Park.

The following shorter excursions are suggested, and American geologists familiar with the regions stand ready to conduct parties. If a sufficient number agree to go on these excursions, concessions may be obtained from the railroads to reduce the expenses to a minimum: (1) Through the Southern Appalachian regions, examining the peculiarly appressed folds in paleozoic rocks, and viewing the newly opened mines of coal, iron, manganese, tin, and gold; (2) to the copper and iron regions of Lake Superior, and the great developments of Pre-Cambrian or Algolkian rocks; (3) through the coal and oil regions of Pennsylvania to Niagara Falls, down the St. Lawrence River to Montreal and Quebec, and return through the classic paleozoic and taconic regions of New York and Vermont.

Members who desire to examine particular localities or geological horizons are requested to correspond with the secretaries as early as possible, and all efforts will be made to arrange so that their wishes may be complied with. Already a short excursion has been planned by Professor H. S. Williams for the week preceding the meeting of the geologists to see the typical development of paleozoic beds (especially Devonian) in the State of New York, in which a number of European geologists have already signified their desire to participate. Correspondence should be addressed to S. F. Emmons, 1330 F Street, Washington, D.C.

BACTERIA.

THE first of a series of lectures on the nature and functions of bacteria was recently delivered at the Royal Institution, London, by Dr. E. Klein, F.R.S. According to the *Lancet*, to which we are indebted for a brief report of the lecture, Dr. Klein said that perhaps in no branch of biological science had advances in the methods of research within the last twenty-five or thirty years been so enormous as in this subject. In 1828 Ehrenberg recognized the existence in water of minute mobile organisms, which he considered to belong to the group of animalculæ known as infusoria, an assumption which was now known to be erroneous. In 1837 Schwann demonstrated the presence in atmospheric air and in dust of living microscopic beings, which he showed by direct experiment to be endowed with the power of producing in certain fluids those chemical changes termed alcoholic fermentation or putrefaction.

Pasteur fully established the proposition that the different fermentations, such as alcoholic, butyric, acetous, mucous, and lactous fermentations, and also the decomposition of putrescible matter, were caused by definite and different species of such minute living beings, microbes, and that without them such changes did not occur. This proposition implied that these changes were dependent on and ultimately bound up with the life and growth of these microbes, and if these were prevented from gaining access to such fermentative matters, they would remain unchanged or sterile. This was the principle which Sir Joseph Lister had applied in surgery, with the well-known brilliant results. The *rôle* of these microbes in atmospheric air had been minutely worked out and beautifully illustrated by Professor Tyndall, who shared in finally establishing that with these simple organisms, belonging almost to the world of the infinitely small, the same fundamental principle obtains as in other living organisms of plant and animal life, be they ever so large and complex, namely, that each organism had descended from an antecedent parent organism, and that no such thing as their origin from non-living matter occurred.

Within comparatively recent times it has been shown that a variety of the most important and extensive processes of oxidation and reduction which occur in nature, — such as the oxidation and resolution of dead animal and vegetable matter, the breaking up of complex nitrogenous materials and their ultimate change into nitrites and nitrates, and the specific fermentation so important in foodstuffs and articles of diet, and many other processes, — are caused by and intimately connected with the growth and life of microbes. Though the importance of some species as useful agencies in nature is recognized, the importance of other species, as being the cause of disease affecting plants, animals, and man, is not less. The term micro-parasite is given to this latter group.

Amongst the microbes there is one great group to be dealt with in particular, called "bacteria," because it possesses more or less the shape of a minute rod. Like the true or higher fungi, they are free from chlorophyll, and are composed of cells, a cellular membrane with living matter or protoplasm within, and they multiply by fission, for which reason they are called "fission fungi." Bacteria can then be defined as microscopic elementary organisms, composed of a cellulose investment of the protoplasmic contents, and which multiply by simple fission. They are classified into micrococci or cocci, bacilli, and spiral vibriones, according to whether they are spherical, cylindrical, or curved and spiral.

All these organisms, when they have found suitable nidus, multiply with enormous rapidity. It has, for example, been found from observation — all conditions of moisture, medium, and

temperature being favorable — that some multiply in twenty minutes, others in thirty minutes, and others in forty minutes.

Staphylococcus aureus, which in its growth produces a peculiar golden-colored filament, grows with great rapidity when sown in a medium like faintly alkaline broth at a temperature of 37° C. Into a sterile broth tube a definite number of organisms are put, say eight cocci per cubic centimetre. If placed in an incubator for twenty-four hours at 37° C., and then counted, it is found that 1 cubic centimetre contains 640,000; that is to say, one organism has multiplied eighty thousand-fold in the first twenty-four hours. It would not be expected that the same rate would obtain in the second twenty-four hours, because the material had been used up. After forty-eight hours' growth the counting yielded 248,000,000 per cubic centimetre; that is, only four hundred-fold. In seventy-two hours it was found that there were 1,184,000,000 per cubic centimetre; that is to say, during the last day each had multiplied only five-fold. As the material is used up the rate of multiplication decreases.

Another instance of the rapidity of growth was given. A rabbit was inoculated subcutaneously with 20,000 bacilli of fowl cholera, and died in twenty-four hours. It was found that 15,150,000 microbes were contained in one cubic centimetre of the blood of the animal. The whole of the blood contained twelve hundred millions, showing that each bacillus in twenty-four hours had multiplied sixty thousand times. Those organisms which have their habitat in ordinary temperatures grow very rapidly. Professor Ferdinand Cohn was the first to study the rate of multiplication on the hay bacillus. He calculated that in two days the number of these would be so great that the whole Atlantic Ocean would be densely peopled by them if there was sufficient nutriment, which, fortunately, there is not, and therefore many of them had to go to the wall.

By the motility of bacteria is understood active locomotion. They spin round, they dart to and fro, and pass rapidly over the field of the microscope, and that is on account of their possessing one, two, three, or even a multitude of fine hairs. The organism of typhoid fever possesses several of these *flapellæ*. It has been shown that for retaining this motility a plentiful supply of oxygen is required. If, in a chamber, at one end oxygen is supplied, and at the other nitrogen or hydrogen gas, the organisms will all move towards the end where the oxygen is. If the oxygen is replaced by nitrogen or hydrogen the movement gradually ceases. If water is covered with a scum, it is most probably a motile bacillus which grows in the fluid, and is driven to the surface, where it can derive the best supply of oxygen. In many cases the motility of the organisms is interfered with by their own chemical products.

Within certain of these organisms, but not in all, are formed peculiar corpuscles, which bear the same relation to the organisms as the seed does to the plant. This spore formation is almost entirely limited to the order of bacilli, and in this group there are very many species which do not possess this power. In a number of different species of bacilli, some of which are capable of forming spores and others not, those which have this power may look on very quietly, while those that do not will exhaust all the nutritive material present, growth and multiplication will then cease, and they will gradually die away. Those which form spores have a much better chance of bringing forth new generations than the others.

When organisms do not find suitable materials for their growth, certain changes are brought about called "involution changes." When the bacillus ceases to possess that high degree of vitality that the normal typical bacillus possesses, it gradually undergoes changes which lead to its death. Illustrations were given of what had been described as involution changes, but which were not so. For instance, tubercle bacilli grown under not very favorable conditions may be swollen, and others may appear branched. Some observers took these changes to indicate the death of the organism, but the lecturer was not quite sure that such were "involution changes."

In all these considerations, particularly in reference to the formation of spores, there were a number of facts of very considerable practical importance. The germination of those organisms which form spores takes place on the same principles as the germination of the spores in the higher fungi. The envelope is broken, the protoplasm contained within it shoots out in the shape of a rod, which when it is fully formed elongates, divides, and multiplies, as in the case of the parent. In this way one bacillus, by repeated multiplication, forms a new crop. When these have reached a certain phase of development they again form spores, which go to start a new generation. These spores have a much greater power of resistance than is possessed by the non-spore-bearing organisms, and can withstand high temperature, dryness, and the influence of light, so much so that it has become almost a recognized method of determining whether a particular species of bacilli forms spores, by subjecting the suspected organism to a temperature of 95° C. or 100° C. If they survive this exposure, and if they survive drying, it may be taken as established that the growth is spore-forming.

HEALTH MATTERS.

The Transmissibility of Hydrophobia from Man to Man.

THE fact that no instance is on record of hydrophobia having been transmitted from man to man has given rise to a doubt as to whether the saliva of human beings suffering from the disease possesses the same virulent properties as that of the dog similarly affected. In not more than five or six of the ten thousand patients treated at the Pasteur Institute was the lesion due to bites inflicted by human beings, and it is evident that statistics bearing on so small a number of cases are of no value one way or the other. It has, however, been proved experimentally, says the *Medical Press*, that the saliva of human beings having succumbed to hydrophobia produces the disease in animals by inoculation, though the incubation period is somewhat prolonged. It may, therefore, be taken as proved that the disease may be transmitted in this way from man to man. It is hardly possible as yet to affirm categorically the possibility of curing hydrophobia after the characteristic symptoms have made their appearance, but recent observations throw a doubt on the incurability of the disease even under these circumstances.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Glacial Grooves on Kelley's Island to be Preserved.

THE world of science will rejoice that at last the most remarkable of the glacial grooves on Kelley's Island is to be preserved as an object-lesson to future generations forever.

Many of the citizens of Cleveland will remember that when, in 1888, the American Association for the Advancement of Science met in their city, an excursion was made to Put-in-Bay on the steamer "City of Cleveland," and that, on the way, the boat stopped at the dock of the Kelley's Island Lime and Transport Company, on the north-east corner of the island, to give the men of science an opportunity to see what there was left of the wonderful glacial grooves that have made that locality famous the world over. A few minutes after the palatial steamer touched the dock at the lime-kilns, the hundreds of expectant excursionists might have been seen swarming around and over the great natural wonder they had come to see, and inspecting it from every point of view. They had come, they had seen, and they were conquered. The expressions of astonishment and delight from the eminent scientific men in the company (among whom were numbered Professors Alexander and N. H. Winchell, Professor Cook of New Jersey, Professor Morse of Boston, Major Powell of Washington, Professor Spencer of Canada), as well as from the great number of intelligent amateurs and others present, were of the most extravagant character; and ardent desire was expressed on every hand that measures might be taken for the preservation of the renowned glacial phenomenon, concerning which all felt that the half had

not been told them. But, alas, the interests of a great business corporation seemed to demand the destruction of the last remnant of these most celebrated works of the glacial age. Many were the regrets expressed at the near prospect of the accomplishment of this real calamity to the interests of scientific education.

But so it was not to be. Mr. M. C. Younglove, the president of the company, then gave his word that the groove which had excited their admiration should be preserved. For three years the workmen have sacredly spared the spot. Gunpowder and dynamite have been kept from injuring these most wonderful exhibitions of nature's most wonderful geologic work, until we are permitted to record that to-day it has been placed beyond danger. At Mr. Younglove's invitation, Rev. Dr. Sprecher and myself have carefully surveyed the premises with him, and, on presentation of the case to the company at its annual meeting on the island to-day, the following resolution was unanimously passed:—

"Resolved, that, in the name of this corporation, the secretary and treasurer be and are hereby authorized to deed to Mr. M. C. Younglove a piece of the groove at the south-east corner of the north quarry at Kelley's Island, said deed to convey a strip of land fifty feet wide and one hundred feet long; said strip of land to be deeded by him to some scientific or historical society, to be preserved in perpetuity for the benefit of science."

This was adopted by unanimous vote of the stockholders.

The grooves thus preserved are probably the most remarkable in the world. They occur in the hard limestone of the vicinity, where the ice movement from the north-east encountered the projecting rock, and spent its main force upon it. As the ice pushed up and over the obstruction, a mingled mass of mud, sand, gravel, and bowlders was shoved along beneath it. Under this force the bowlders became ploughshares; the gravel and sand, rasps and files; and the frozen mud, a pumice-stone to furrow and score and polish the whole. Originally a large area of this glaciated surface was exposed to sight. But in the progress of work upon the extensive quarry, the larger part of it has been removed. What is left, however, is ample for an object lesson. The portion of the groove preserved is thirty-three feet across, and the depth of the cut in the rock is seventeen feet below the line extending from rim to rim. Originally there was probably here a small depression formed by pre-glacial water erosion, into which the ice crowded the material which became its graving tool; and so the rasping and polishing went on in increasing degree, until this enormous furrow is the result. The groove, however, is by no means simple, but presents a series of corrugations merging into each other by beautiful curves. When exposed for a considerable time it will resemble nothing else so much as a collection of prostrate Corinthian columns, lying side by side on a concave surface.

These grooves have long attracted the attention of the collectors of geological curiosities. Those persons in Cleveland who are interested to see specimens of this remarkable phenomenon can gratify their desire by noticing the collection of stones on the Public Square, just opposite the First Presbyterian Church. This was placed there by the Western Reserve Historical Society, and contains one of the first millstones used in the country. But beside it is a notable fragment of one of the glacial grooves from Kelley's Island. Mr. Younglove also has a still more remarkable specimen in front of his residence at 614 Euclid Avenue. Specimens of these grooves have also been procured for the Harvard College Museum, and a specially large and fine one was sent a year ago by Mr. Younglove to Oberlin, and adorns the college park in front of the library.

Col. Whittlesey paid much attention to the study of the grooves on Kelley's Island as they were in progress of being uncovered, and secured many fine specimens for the collection of the Historical Society, which can be seen in their rooms. The society also has a large number of original drawings of the grooves, executed by Col. Whittlesey, and accompanied by much unpublished descriptive matter. Neither has attention to those remarkable exhibitions of glacial action been confined to this country. In my recent work on the "Ice Age in North America," I have taken pains to introduce several photographs from this place. In a recent issue the London *Athenæum* (March 28, 1891) fairly went into ecstacies over them, exclaiming, "How paltry appear the furrows ploughed by ice on our glaciated rocks beside the monstrous groovings eroded on the Sandusky Islands in the western part of Lake Erie, and figured from photographs, at pp. 232–242 of this book."

The direction of these grooves is a little south of west, corresponding to that of the axis of the lake. This is nearly at right angles to the course of the ice scratches on the summit of the water-shed south of this, between the lake and the Ohio River. The reason for this change of direction can readily be seen by a little attention to the physical geography. The high lands to the south of the lake rise about seven hundred feet above it. When the ice period was at its climax, and overran these high lands, it took its natural course at right angles to the terminal moraine, and flowed south-east, according to the direction indicated by the scratches on the summit. But when the supply of ice was not sufficient to overrun the high lands, the obstruction in front turned the course, and the resultant was a motion towards Toledo and the Maumee Valley, where, in the vicinity of Fort Wayne, an extensive terminal moraine was formed. The grooves on the islands near Sandusky were produced during that stage in the recession of the great ice-sheet.

The groove preserved is only a small portion of what still exists, but it would be too much to ask to have more given by the company. As it is, the public spirit shown by the directors, gathered from Boston to Duluth, has rarely been equalled by a similar corporation. Quarrying has already proceeded nearly all around this specimen, and soon the monument preserved will be a monument indeed, the groove being left to cap a pedestal about thirty feet high, and conspicuous from every side. About one half the surface will be cleared of *débris*, so as to show fifty feet of the length of the groove, while the other half will remain as it is, beneath its protective covering of pebbles, gravel, sand, and mud, which acted as the graving tools in the firm grasp of the ice. In this condition it is to be presented to the Western Reserve Historical Society of Cleveland, to remain for the admiration and instruction of all future generations. I trust the citizens of the vicinity will appreciate the noble gift enough to occasionally visit the place and receive the deep impressions it is so well calculated to make.

G. FREDERICK WRIGHT.

Kelley's Island, O., June 9.

Pacific Air over the Rocky Mountains.

IN last August I called attention in *Science* to the enormous mass of Pacific air which for three months had been passing eastward over the mountains: also to the fact that there had been but little precipitation during the summer until near the middle of August, when, for the first time, solar halos appeared, and were followed by violent electrical storms. From September to the middle of last January the atmospheric circulation was in general feeble, consisting largely of gentle winds from the north-west. Late in January the south-west currents began to flow again, at first feebly, but becoming more and more persistent and aggressive. A remarkable series of storms has followed, one storm following another at intervals of four days to three weeks. At first, after a rush of north wind had ended a storm, it would be one or two weeks before the south-west winds were re-established. But as time went on it took less and less time, until in April two of the worst of northers cleared off with the upper south-west wind still in possession of the field, rushing over the higher mountains as if nothing had happened, and in a few hours it became the surface wind on the plains. At present the plains near the mountains are wetter than for years.

I have had opportunity to observe these storms at a point 20 miles east of the mountains, 27 miles north-east of Colorado Springs, at 6,800 feet elevation, and near the top of the high ridge which extends east from the mountains known as the Divide between Arkansas and Platte waters. Seen from that place the most common development of the general storms was as follows. First, high cirrus streamers and films are seen coming from the quadrant south to west, more often from about south-west. For a day or more the surface winds continue variable, but finally the south-west wind descends to the surface. Then for several days the south-west wind continues, sometimes with a high velocity.

The temperature rises, and the region no doubt by degrees becomes warmer than the adjacent regions or the high air above it.

Presently the time comes when the high cirrus rapidly thickens, the cigar-shaped masses of cirro-stratus or cirro-cumulus appear at lower levels, and soon a tumultuous mass of cumulo-stratus clouds develops far below. The latter frequently envelop the top of Pike's Peak, so they are from a mile to a mile and a half above the plains. These clouds soon coalesce into a continuous sheet, which develops fringes and festoons on its bottom and outer margin, and thus continues to descend. At this time there is usually but little surface wind. Sometimes the storm reaches this stage and then clears up again. When the cloud has nearly reached the plains there is a sudden rush of wind at the surface, bearing snow or rain. Usually the storm is inaugurated by a succession of squalls or hail-storms, — sometimes from the north. These squalls are often electrical. As squall follows squall the festooned outer border of the storm-cloud can be seen to enlarge laterally and sink to lower levels. The surface temperature rapidly falls, and the local storm-areas become connected by a great but not wholly homogeneous cloud of precipitation, which rushes either south or north over the Arkansas-Platte Divide. When the lower wind is at first from the south, it usually swings around to the east, then north-east, and finally north. This usually completes the storm, but not seldom the cycle is repeated. Often a rush of north wind for several hours is followed by a south wind, and then by a north wind again. During all this time there is more or less precipitation. Usually we are enveloped in the clouds of precipitation, but often there are small rifts in these clouds, through which the upper air movements can be observed. In this manner I have observed in almost every storm the higher clouds (mostly cirroid) coming rapidly from the south-west for one or two days after the under-rush of cold saturated air began transverse to their direction. No matter whether the under-currents are going north, south, or west, the storms usually continue till the upper cirrus comes from the north; then the surface wind soon turns into the north, and the storm clears off cold. The lower cloud from which the precipitation occurs is seldom homogeneous in structure. In almost all cases it consists of a series of squalls, the local storm-areas being connected by stratus. This seems to be the general law of the Great Basin also. After general storms I have seen, both on the Wasatch and Rocky Mountains, great variations in the depth of snow on plains and mesas that could not be accounted for by differences of topography and altitude. In a recent rain-storm that covered a large part of Colorado east of the mountains these local storms were unusually well differentiated. The general storm began as a series of small thunder-storms, affording both hail and rain, each electrical area showing massive black cumulus clouds, which could easily be distinguished from the leaden and rather homogeneous stratus which extended from one of the local storm-areas to another. At one time three of these local storms could be seen in different directions. The development of the storm was signalized by a great fall in temperature. All the clouds afforded rain, but the fall was much more rapid from the electrical areas.

On June 9 a storm occurred as follows. The upper cirrus had been coming from the south-west for about three days, and hot winds from the same quarter had prevailed much of the time at the surface. During the night of June 8–9 there had been a heavy dew, a rare occurrence on the plains. Early June 9 a series of broad tracts of cirro-stratus formed along the eastern base of the mountains. Their western edges were situated a little east of the mountains. So near as the eye could estimate, these clouds occupied the same position all day. The separate flocks and fibres could be seen moving rather rapidly from the south-west. Evidently new cloud-fibres were being formed at the western edges of the cloud masses as fast as those already formed moved north-eastward.

During the afternoon there were numerous abortive attempts at storms on the mountains. Just before sunset an electrical storm began near the top of the Arkansas-Platte Divide. It was narrow, perhaps five or ten miles wide, from east to west, but it rapidly prolonged itself to a length of a hundred miles or more from north to south. The most important facts about this storm are these: the south to south-west winds which had prevailed at the surface during the day gave place to a violent cold wind from the north at the moment the storm-cloud was formed; moreover, this long, narrow storm was generated, as nearly as the eye could estimate, along the exact north-and-south line where during the earlier part of the day the formation of cloud had been going on along the western edges of the cirro-stratus tracts. The north wind raged at a high velocity for several hours.

This was peculiarly a plains storm. To the west there appeared but few clouds, and no storm of consequence was visible for at least two hundred miles along the mountains. Even Pike's Peak, who insists on dipping his head into every storm that comes into this region, had for once to be content with a few scattering clouds about his shoulders, and looked on in utter helplessness.

Summary. — (1) Over the mountain region there has been since January a very great and persistent movement of air from the south-west. (2) Unlike last summer, only a few days have at any time elapsed before halos and sun-dogs have appeared near the sun. They have invariably been followed by a rush of cold at the surface, causing abundant precipitation. (3) During the general storms of the winter and spring, the movement from the south-west continues one to three days after the lower clouds of precipitation have been formed in currents which travel hundreds of miles back and forth in directions transverse or even opposite to the upper movement. (4) The movement of clouds in the high atmosphere from the south-west is in most cases interrupted toward the end of a storm by high currents from the north or north-west; but in a few cases the movement from the south-west was either not interrupted or almost immediately resumed. (5) The formation of the clouds of precipitation during the general storms of winter and early spring proceeds from above downwards, and is usually aided by the development of local storms. There is a sudden and often great fall of temperature at the time the surface clouds of precipitation are formed, and this, too, whether the surface clouds go north or south. The general situation, then, is this: before the breaking of the storm the lower mile or two of the atmosphere consists of air from the south-west of a relatively warm temperature, and generally containing considerable moisture. The temperature is above the saturation point. When the storm breaks upon us the temperature suddenly falls below the point of precipitation and there is a great rush of cold air horizontally.

Several facts deserve special notice in this connection. First, the precipitation continues from five to forty or more miles after the surface under-current which contains the cloud of precipitation has passed the top of the Divide, hence while the air is being warmed by condensation while descending from five hundred to two thousand feet. Here is greater cooling than could take place from rarefaction alone while the air was being forced to higher elevations. Second, the cold under-current affords abundant precipitation, often for twenty-four to forty-eight hours, long enough for three hundred to twelve hundred miles of wind to pass. It is therefore a moist wind.

Now, no cold wind from either north or south could become colder in sinking from higher to lower levels, nor could it in descending to the earth become super-saturated with moisture, whereas it contained no clouds of precipitation at higher levels. We have therefore to look for the precipitated moisture in the lower atmosphere, which in this case is relatively warm up to the breaking of the storm. The most probable interpretation of the facts would seem to be this: the cool under-currents which bring the rain or snow consist mainly of the surface air, much of which is fresh from the Pacific region. This surface air becomes mixed with considerable bodies of cold air, which descend from above both at the fringed clouds and especially at the local storms. This cold air would be dry, but would receive radiation from the surrounding masses of warmer air, and thus cool them, and would partly mix with them. This cooling goes on in spite of the latent heat set free at the condensation of the vapor.

It is not my present purpose to discuss the mechanism of these movements whereby vast bodies of air leave an ocean warmed by the Japan current and press eastward so persistently over a dry, cold, and elevated plateau, and high range of mountains. That

would involve the question of a great Pacific atmospheric whirl, comparable to the supposed general movement during winter about the area of low pressure in the northern Atlantic. It would also involve a comparison of our weather here when we are in the Atlantic whirl with that which comes when the Pacific circulation pushes eastward over the mountains. There are numerous other questions involved in these observations, but they are postponed.

G. H. STONE.

Colorado Springs, Col., June 15.

Consecutive Lightning Flashes.

ABOUT 5.45 P.M. yesterday, while travelling over the "Jersey flats" on the Delaware, Lackawanna, and Western Railroad, I saw toward the south-west no less than six strokes of lightning following the same path — a nearly vertical one — in quick succession. The number was obtained from the grouping or "phrasing," as it were, of the flashes, which impressed itself on my mind. First there was a single flash, then a group of three, and then a group of two. They followed one another so rapidly that their separate character could just be distinguished, and the duration of the six must have been less than a second. I was at first inclined to believe that the paths had been precisely the same, even to the slightest sinuosity, but I am now inclined to think that they varied slightly, and that this variation aided me in recognizing their separate character. I am not aware that so many consecutive strokes have ever been noticed before. It may be interesting to add that this morning's papers report great damage by lightning in Elizabeth, N.J., in the direction of the observed flashes.

ARTHUR E. BOSTWICK.

New York, June 17.

Mocking-Birds and their Young.

AN educated Southern lady made to me the following statement, which seems too extraordinary to be true. My informant honestly considers it a fact. Is it true, or is she deluded by some accident? I leave the matter for those learned in the lore of birds to decide.

My friend says that while living in Mississippi, she frequently took young mocking-birds from a nest near the house, and placed them in a cage hanging on the verandah. The parent birds came, not to feed the young, but to endeavor to liberate them, by plucking at the cage. Failing in this, my friend says that they invariably brought to their imprisoned young bitter-sweet berries, which poisoned them, the birdlings only living a very short time after receiving the berries. She further said that the captives would do well as long as the parent birds were kept from the cage, but if by any inadvertence the cage was left on the verandah while the family went into the house, on returning they would find the bitter-sweet berries in the cage, and the little fledglings in a dying state. My informant further declared that this had occurred again and again within her experience, and that her grandfather gave strict orders that no mocking-birds should be captured, as their death would certainly be effected by the old birds. This is a strange story of bird-ways, that birds should be capable of choosing for their progeny death rather than captivity! I wish some of the Southern readers of *Science* would observe in the mocking-bird direction, and give us positive and recent information from careful experiment.

JULIA MCNAIR WRIGHT.

Fulton, Mo., June 16.

Thunder-Storms.

IT has been noticed in connection with thunder-storms in this vicinity this season that in every instance there has been an outflow of air in every direction from the storm, extending even beyond the area of precipitation and cloudiness. For example, in the case of a storm appearing upon the south-western horizon and moving due east, and passing then three or four miles south of this village, the weather-vane pointed directly toward it continuously, veering slowly from south-west to south-east, showing that the wind came steadily from the storm. The same thing also occurred in the case of a storm which appeared upon the north-western horizon and moved eastward, passing three or four miles north of the village. In this case the vane pointed directly toward the storm throughout, the winds being quite brisk. In other instances in which the storms passed directly over the village the same thing was manifest, the vane shifting sharply from west to east as the storms passed. In previous years I have noticed the puff of wind in front of an advancing thunder-storm moving in the same direction as the storm itself and occurring just before the rain begins to fall, but my attention has never been called to such an outflow of air in every direction as has been apparent in connection with thunder-storms recently. Whatever may be its explanation, it certainly is entirely inconsistent with the idea of an indraught and uprush at the centre of the storms in which it occurs.

M. A. VEEDER.

Lyons, N.Y., June 22.

BOOK-REVIEWS.

The Modalist, or the Laws of Rational Conviction. By EDWARD JOHN HAMILTON. Boston, Ginn. 8°. $1.40.

THE author of this work claims to have perfected the science of logic. He says in his introductory chapter: "The treatise now offered to the public is the result of long-continued studies which have had for their object to place the doctrines of logic on satisfactory foundations; and it would be false humility were the author to conceal his assurance that these studies have been successful. He claims to have completed a work which Aristotle left unfinished." And again he says, speaking of himself: "He knows what he has been enabled to do; he is certain that he has found the truth on every important point" (pp. 1 and 3).

When we come to examine the improvements that Mr. Hamilton claims to have made in the science, we find that they consist mainly in the introduction of modal syllogisms, that is, syllogisms in which the conclusion is expressed in terms of possibility, probability, or contingency, as distinguished from the ordinary, or pure, syllogism, in which the conclusion is categorical. Such syllogisms were treated of by Aristotle, but modern logicians have rejected them as not properly belonging to the science, since possibility, probability, etc., belong, not to the form of thought, but to its matter. They are properties, not of our thought, but of the facts and events that we think about, and therefore have no proper place in a work on theoretical logic. Mr. Hamilton, however, gives such modal syllogisms the foremost place among the forms of reasoning, affirming that "the pure syllogism is the secondary mode of thought, and should be interpreted by the modal." Yet he immediately adds that the pure syllogism "is the best expression of our ordinary reasonings" (p. 262), an admission which is fatal to his whole theory.

Another of Mr. Hamilton's innovations consists in treating the principle of antecedent and consequent, which lies at the basis of the hypothetical syllogism, as the first principle of all reasoning, even in the ordinary syllogism. Such a turning of logic topsy-turvy as Mr. Hamilton proposes seems to us the reverse of an improvement, and we believe it will be so regarded by thinkers generally.

AMONG THE PUBLISHERS.

AN illustrated article by Edwin Checkley, which introduces some of his new theories of physical culture, forms one of the features of the July *Lippincott*.

— Among its contents the *Chautauquan* for July has the following: "A Symposium — Where Should a College be Located?" by Julius H. Seelye, Henry Wade Rogers, James B. Angell, Hjalmar Hjorth Boyesen, W. R. Harper, and Herbert B. Adams; "Modern Methods of Treating Inebriety," by H. R. Chamberlain; "Objections to College Training for Girls," by Emily F. Wheeler; and "Elizabeth Thompson, the Philanthropist," by Frances E. Willard.

— The publishers of the *Illustrated American* of this city announce a *Monthly Illustrated American*. The monthly has been planned for over a year, and is offered to the public as "the cheapest and best illustrated magazine in the world." It is com-

posed of the magazine element of the weekly. Although the pictures will be, in the main, those employed in the weekly several months ago, there will be new and attractive reading matter. If it were not for this use of the plates the monthly would be an impossibility, the cost of making it being so great. The expense of publishing a weekly magazine of the character of the *Illustrated American* is so heavy that its price must necessarily be higher than the long-established weeklies. This price is the means of deterring many thousands from purchasing it, and in order to give people of small means a magazine at a nominal price it has been decided to issue the monthly at one dollar a year. Those who do not know the *Illustrated American* should ask for it the next time they pass a news-stand.

— G. P. Putnam's Sons have in press "The Living World: Whence it Came, and Whither it is Drifting," a review of the speculations concerning the origin and significance of life, of the facts known in regard to its development, and suggestions as to the direction in which the development is now tending, by H. W. Conn, professor of biology in Wesleyan University.

— A. E. Seaton, who is connected with Earle's Shipbuilding Company of Hull, England, will contribute to *Scribner's* steamship series an article on "Speed in Ocean Steamers," to appear in the July number. Commenting on the probability of "five-day steamers" on the Atlantic the author says: "It is always a question of *cui bono*, and when it is taken into consideration that the voyage between Sandy Hook and Queenstown is now done in 140 hours, and to do the distance in five days would require a speed of nearly 23½ knots, with an increase in power of sixty-two per cent, and in fuel consumption of thirty-eight per cent, the cry must be regarded as a very far one at present. At the same time it is not desirable to believe that there is now finality in the speed of steamships, although by analogy with railway trains that conclusion might be arrived at."

— Macmillan & Co. have nearly ready for publication "A History of Human Marriage," by Dr. Edward Westermarck, lecturer on sociology at the University of Finland, Helsingfors. In an introductory note the work is commended to the attention of students by Dr. A. R. Wallace, who expresses a high opinion of the learning and insight displayed by the author. Dr. Westermarck differs widely in many respects from the opinions hitherto held by most anthropologists as to the development of the various forms of marriage.

— S. E. Cassino, 196 Summer Street, Boston, announces that the next edition of the "International Scientists' Directory" will be issued in the first half of 1892, two years from the date of publication of the former one. It is hoped that the new edition will contain nearly double the number of addresses given formerly, and the editor will be greatly pleased to receive any names which should be included. The foreign portion will be much more complete than formerly.

— The most prominent article in the *Review of Reviews* for July will be one prepared by Professor Herbert B. Adams of the Johns Hopkins University, entitled "University Extension and its Leaders." It is an account of the popular movement for the dissemination of advanced education among the people, in which the leading educators of America are now earnestly engaged, and it is illustrated with portraits of Professor Adams himself, Bishop Vincent, the head of the Chautauquan movement, Presidents Eliot of Harvard, Dwight of Yale, Adams of Cornell, Gilman of Johns Hopkins, Low of Columbia, Harper of Chicago, Northrop of Minnesota, Mr. Melvil Dewey, Professor E. J. James, and various other gentlemen. It may not be generally known in this country that the public school boards of Paris, London, and other great foreign cities, have finally come to the conclusion that it is necessary to feed, once a day at least, in all the public school buildings, the children of the poorer classes, in order to be sure that they may be in physical condition to receive intellectual instruction. An article in the same number of the *Review* entitled "Food-Aided Education in Paris, London, and Birmingham," gives an account of the system under which this novel reform has been put into practice.

— An interesting paper on the habits of the moose, by Mr. J. G. Lockhart, appears in the June number of the *Zoölogist*. One of the points noted is, that moose generally lie with the tail to windward, trusting to their senses of hearing and smelling, which are remarkably acute, to warn them of approaching danger from that quarter. They can use their eyes to warn them from danger to leeward, where hearing, and especially smelling, would be of little use. While they are sleeping or chewing the cud, their ears are in perpetual motion, one backward, the other forward, alternately. They also have the remarkable insight to make a short turn and sleep below the wind of their fresh track, so that any one falling thereon and following it up is sure to be heard or smelt before he can get within shooting distance.